ON THE APPLICATION DATA SHEET

Please correct the spelling of the city of residence of the inventor, Leo A. Metzger, from "Circleview" to – Circleville – .

IN THE CLAIMS:

Claims 1, 3, 6 and 7 as set out below. Add claims 8 and 9.

1. In an agricultural machine having an adjustable platform supported by the machine and a control system for setting an operating height of said platform relative to the ground, said control system including a sensor responsive to an angular position of a shaft and generating a signal representative of said operating height, a sensor arm coupled to said shaft and comprising an operating portion for contacting the ground and being curved at the segment of said operating portion adjacent said shaft, such that the distance between a center of rotation of said shaft and the point at which said sensor arm contacts the ground decreases as the operating height of said platform is decreased.

3. The apparatus of claim 2 wherein said sensor arm includes a forward curved portion extending from a location adjacent said shaft rearwardly to a transition region and having a first radius of curvature, and a second curved portion rearward of said first curved portion and extending from said transition region to a location adjacent the rear end of said operational region of said sensor shaft and having a second radius of curvature.

6. In an agricultural machine having a platform carried by the machine, and a control system for setting an operating height of said platform relative to the ground, said control system including a sensor mechanism comprising a member rotatable about an axis, a sensor arm mounted to said rotatable member and including an operating portion for contacting the ground, characterized in that a forward segment of said operating portion is substantially continuously curved whereby when said platform is set at a lower operating height, the distance between said rotatable member and the point at which said arm contacts the ground continuously decreases as the operating height of said platform is decreased.

7. The apparatus of claim 6 wherein said curved portion of said sensor arm comprises a first curved portion having a substantially constant first radius of curvature, and said sensor arm includes a second curved segment rearward of said first curved segment and characterized in having a second radius of curvature, said second radius of curvature being greater than said first radius of curvature, whereby the magnitude of response of said control system is greater for lower operating heights of said platform than is the response magnitude for higher operating heights of said platform.

8. The apparatus of claim 2 wherein the curvature of said sensor arm is such that an angular displacement of said shaft increases for a given height of ground rise as the operating height of said platform decreases.

9. The apparatus of claim 6 wherein said sensor arm has a curvature of said operating portion thereof which is such that an angular displacement of said shaft increases for a given height of ground rise as the operating height of said platform decreases.

REQUEST FOR EXTENSION AND FEES

Applicant hereby requests an extension of time of one month to respond to the last Office Action. A check in the amount of $55.00 is enclosed herewith to pay the fee for the request. This amendment results in the addition of two dependent claims. Since the total number of claims, including this Amendment, does not exceed 10, it is deemed that no additional fee is required with this Amendment other than for the request for an extension of time of one month. However, should any fee be deemed to be required, authorization is given to charge any fee or to credit any overpayment resulting from this Amendment to account number 05-1060.

RESPONSE

The above amendments to claims 1, 3, 6 and 7 address each of the formal objections raised by the Examiner in paragraph number 2 of the Detailed Action. The comments of the Examiner are appreciated in this regard. In addition, applicant has added claim 8 which is dependent on claim 2, and claim 9 which is dependent on claim 6.

The Examiner has rejected the claims as anticipated by the disclosure of Jensen, et al., U.S. Patent 4,147,016 ("Jensen"). Applicant respectfully submits that Jensen

22

A

does not anticipate the instant claims. Rather, Jensen, it is submitted, is illustrative of the type of sensor arm found in the prior art which exhibits the shortcomings or disadvantages overcome by applicant's claimed invention.

To understand applicant's invention, it is first necessary to understand the structure and operation of Jensen. The Examiner correctly indicates that Jensen discloses an agricultural machine having and adjustable platform and a control system for setting the height of the platform relative to the ground. The Examiner continues that the control system of Jensen includes a sensor 38 responsive to the angular position of a shaft member around an axis, and the Examiner refers to FIG. 4 of Jensen "below the reference point 170". Applicant believes that statement may include a misunderstanding from which the Examiner's understanding of the operation of Jensen is incomplete.

Referring to column 7, beginning at line 9, Jensen states that his sensor 38 is comprised of "an elongated member 170 pivotally mounted at one end thereof to the end 42 of the head housing 44", and that the "opposite end of the member 170 is pivotally coupled to one end of a rod 172 and has a curved feeler 174 extending therefrom into contact with the surface of the ground". (Id., lines 9-15). In other words, the sensor structure of Jensen includes an upper straight member 170 which is pivoted at its upper, forward end to the end 44 of the header (see FIGS. 5 and 6 of Jensen). The curved feeler 174 of Jensen is then rigidly mounted to the elongated

A

member 170. This is more clearly shown, it is submitted, in FIG. 6 of Jensen, for the sensor 37 on the opposite side of the header.

The important point is that the feeler 174 and the elongated member 170 are an integral, rigid structure. The curved feeler 174 is not pivotally mounted to the member 170. It is the rod 172 which is pivotally mounted to the lower rear portion of the elongated member 170. This can be seen from the manner in which the sensing system of Jensen works. As a rise in the level of the ground is experienced, the curved feeler 174 rises, the sensor rotates counterclockwise (in FIG. 4), and the arm 172 is translated, similar to a four-bar linkage, to rotate the crank 176 counterclockwise about its pivot, thereby moving the actuator rod 180 to control the valve 154 which actuates the hydraulic cylinder 112 to raise the header when a rise in ground level is sensed, and to lower the header when a depression is sensed. The structure of Jensen illustrates vividly, as we will show, the shortcomings of that sensor structure, which is typical of the prior art. These shortcomings are illustrated in the accompanying drawings.

Before discussing the operation of Jensen, the Examiner has raised a preliminary issue that requires a response. That is, the Examiner asserts that the area of Jensen's feeler to the left of the lead line for reference numeral 174 has one curvature and the portion to the right of that lead line has a second curvature. Applicant traverses that statement. There is no teaching in Jensen that the curved portion 174 of the feeler 38 has a curvature other than a constant curvature. This appears to be clear from the drawings of Jensen as well, including FIG. 6. Nor is there any suggestion that any

A

curvature of the feeler other than a constant radius (as appears to applicant to be the case) can serve a purpose or provide an advantage.

Enclosed is a photocopy of FIG. 5, enlarged slightly, with a circle of 0.5 in. diameter inscribed in red over the curved feeler using a standard drawing template. Jensen's feeler is clearly of constant or substantially constant radius.

However, as persons skilled in the art will realize, even if the curvature of the portion 174 of Jensen were modified slightly so that its curvature was not constant over the entirety of the curved portion which is disclosed by Jensen, it would not affect the operation of Jensen materially from what will be described below. The reason is that the round feeler 174 of Jensen is displaced substantially from the axis of rotation of the feeler – that is, the length of the member 170 is substantial in relation to the linear distance (i.e., circumference) of the curved operating portion of Jensen.

Turning then to the enclosed drawings, which are marked respectively as Exhibits A through F, there are four drawings (Exhibits A-D) and two graphs (Exhibits E and F).

Exhibit A shows both the Jensen round feeler 174 and the sensor arm 174 in dashed line and applicant's sensor arm in solid line. Both sensor arms have the same axis of rotation and same point of contact with the ground so that a valid comparison between the two can be made. The drawing of Exhibit A illustrates a header operating height of twelve inches. This is near the maximum operating height of conventional combines, but the principle involved is not dependent on specific header operating heights. It will be seen from Exhibit A that the horizontal distance between a vertical

A

plane passing through the axis of rotation of the shaft and the point of contact of the feeler (the "Horizontal Length") is the same for both systems – 8 ⅞ units. This provides a valid reference point.

Turning then to Exhibit B, the operating height of the header is reduced to six inches, approximately the mid-range of operating height for conventional machines. It can be seen by comparing Exhibits A and B that the Horizontal Length has increased in Jensen to 11 ¾ units and decreased in applicant's structure to seven units. This is because, in essence, as the header lowers, the length of the member 170 of Jensen rotates from approximately 45 degrees with the horizontal plane closer toward the horizontal, thereby, in effect, "pushing" the ground contact point of the associated feeler rearward from that shown in FIG. A, even though the round feeler of Jensen has rotated counterclockwise.

By reducing the operating height of the combine further, to four inches as seen in Exhibit C, it will be observed that the Horizontal Length has again decreased in applicant's device, but has increased further in Jensen -- to twelve units.

Exhibit E is a graph showing the relationship between the Horizontal Length in Exhibit E, and the operating height of the header (as measured from the ground to the axis of rotation of the feeler). It can be seen there that the "Horizontal Length" in Jensen continues to increase throughout the operating range from twelve inches down to four inches as the operating height decreases, whereas the "Horizontal Length" of applicant Metzger continuously and progressively decreases. This "Horizontal Length",

A

it will be observed, represents a delay between the time the machine experiences or passes over a rise in the ground and the time the sensing system responds to the rise.

It is an important advantage of the instant invention that this delay between the time a portion of the header passing over a ground rise and the time when the machine senses the rise is significantly reduced in the instant invention under the operating conditions where it is required most – when the farmer is operating the header at a lower operating height. This is where damage is more likely to occur.

In other words, if the header is operating at a twelve-inch height and a two-inch rise in ground is experienced, the two-inch rise is not a substantial part of the total operating height. However, if a two-inch rise in ground is experienced when the operator is operating the header at a four-inch height, that rise is a substantial portion of the operating height; and early sensing of that variation constitutes a substantial improvement in adjusting the operating height by the feedback control system of the header.

There is a second advantage of the claimed invention, disclosed on page 13 of the application and illustrated in FIGS. 6 and 7 of the instant application. This advantage provides that as the operating height decreases (FIG. 7 to FIG. 6), the sensor "lever arm" 73 (which is the same as the "Horizontal Length" described above) decreases. The instant invention provides that the curvature of the sensor arm produces a result in that the length of the lever arm reduces substantially continuously as the header height setting decreases over substantially the entire operating range. This provides a

A

corresponding greater angular displacement of the sensor shaft for a given height of ground rise as the lever arm shortens (see page 13, lines 18-21 and continuing on to page 14 of the instant application).

This second advantage is illustrated in Exhibit D. In Exhibit D, an operating height of four inches is set. Again, the Jensen device is seen in dashed line, and applicant's device is shown in solid line. In this drawing, a two-inch rise in terrain is experienced for both Jensen's system and applicant's claimed system. The angular displacement of applicant's device sensing this rise is 24 degrees, whereas the angular displacement of the Jensen device is 10 degrees. In other words, for the same operating height and the same rise in terrain, applicant's feeler arm produces a substantially greater angular displacement of the sensor shaft. This results in a more forceful correction of the hydraulic adjusting system as the operating height of the header reduces. In other words, as seen in Exhibit D, not only does applicant's sensor detect the rise in terrain and transmit the signal to the sensing system than in Jensen, but it also provides a more forceful response for the same rise in terrain for the same operating height as the header is lowered to reduced operating heights.

The relationship between the angular displacement of the sensor shaft and the height at which the header is set is illustrated in Exhibit F for a given rise in terrain of two inches for each operating height setting shown. It can be seen that for each operating height below a given starting condition (twelve inches in the example of Exhibit F), applicant's device ("Metzger") produces a greater rotation of the operating shaft for

A

a given rise in terrain, and that the difference in angular displacement increases progressively in the claimed invention over Jensen, beyond the initial point.

Thus, it is shown that applicant's device produces not only a quicker response (i.e., shorter delay), but also a more forceful one as operating heights are reduced, over the entire range of operating heights for which this example is given. The same results will extend if a higher operating height is chosen as long as the conditions of Exhibit A are met. That is, if the axis of rotation of the two sensor arms is the same and the initial ground contact point is also the same.

Turning now to the claims of the instant claims, amended claim 1 recites that the sensor arm comprises an operating portion for contacting the ground which is curved "at the segment of said operating portion adjacent said shaft". This is in stark contrast with the elongated, linear member 170 explicitly disclosed in the prior art of Jensen. Moreover, claim 1 recites that the distance between a center of rotation of the shaft and the point at which the sensor arm contacts the ground "decreases as the operating height of said platform is decreased". This structure has been dramatically illustrated in the exhibits described above; and it is, we respectfully submit, a patentable distinction over the cited Jensen prior art which incorporates the problem and nowhere suggests even that a problem exists -- let alone a solution. In fact, as applicant has demonstrated, the claimed invention operates in a manner which is distinctly different from Jensen's device. Jensen teaches away from the claimed apparatus which decreases Horizontal Length as the operating height of the Leader is decreased.

A

Claim 3 recites the forward and rear curvatures of a sensor arm having first and second radiuses of curvature respectively and wherein the forward portion extends from "a location adjacent said shaft". This structure is not suggested or disclosed in Jensen as discussed above.

Claim 6 recites a sensor arm mounted to a rotatable member including an operating portion for contacting the ground and characterized "in that a forward segment of said operating portion is substantially continuously curved whereby when said platform is set at a low operating height, the distance between said rotatable member and the point at which that arm contacts the ground continuously decreases as the operating height of said platform is decreased". Again, this structure defines an improvement over the prior art which is nowhere taught, disclosed or suggested in Jensen, nor any of the other references cited by the Examiner.

New dependent claims 8 and 9 are directed to structure wherein the angular displacement of the sensor shaft increases for a given ground rise as the operating height is lowered. This represents a substantial improvement over Jensen for all operating heights from an initial start point, as demonstrated in Exhibit F as discussed above. These claims, it is submitted are independently patentable over Jensen.

It is therefore respectfully submitted that all of the claims in the instant application, as amended, are not only not anticipated by Jensen, but clearly defined patentable subject matter in an improved invention over the device disclosed in Jensen.

A

Favorable action is respectfully submitted on all of the pending claims.

Respectfully Submitted,

Date: May 7, 2002

James J. Hill
Reg. 24,287
EMRICH & DITHMAR
300 S. Wacker Dr., Ste. 3000
Chicago, IL 60606-6721
Telephone: (312) 663-9800
Telecopier: (312) 663-9822

H:\Word\EKR\Metzger\Sensor Arm 1\Patent\Amendment A DRAFT 5-7-02.wpd

A